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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,390	01/26/2004	Holger Schlueter	14624-004001	4590
26161	7590	08/08/2006	EXAMINER	
FISH & RICHARDSON PC P.O. BOX 1022 MINNEAPOLIS, MN 55440-1022			VAN ROY, TOD THOMAS	
			ART UNIT	PAPER NUMBER
			2828	

DATE MAILED: 08/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/763,390	Applicant(s) SCHLUETER ET AL.	
	Examiner Tod T. Van Roy	Art Unit 2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 June 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 4-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Claim Objections***

The previous claim objections are withdrawn.

### ***Response to Amendment***

The examiner acknowledges the amending of claims 1, 13, 23, 30, and the cancellation of claims 2-3.

### ***Response to Arguments***

Applicant's arguments filed 06/05/2006 have been fully considered but they are not persuasive.

With respect to claims 1, 4-5, and 30, the applicant has stated that the method by which Arbore teaches to reduce coupling between the core and cladding modes would not allow for confinement reduction in the core of the fiber, and therefor the USC 103(a) rejection is not valid.

The examiner does not agree with the applicant's assertion. As the applicant has pointed out, Arbore states "...ideally there is no coupling between core 24 and cladding mode 26". Thus, in the ideal, or preferred, embodiment of Arbore there is no coupling between these modes (no losses etc. which Arbore cites as the cause for the loss of orthogonality and the coupling of the modes, col.6 lines 4-7). Since the modes would remain orthogonal in the ideal case, a reduction of the confinement of the mode to the core region would not entail any coupling to the cladding mode. Therefor, the coupling would no longer be a problem, and one would be free to choose the optimal amount of

Art Unit: 2828

confinement to the core as they saw fit. For these reasons the USC 103(a) rejection is believed to be valid, and obvious to one of ordinary skill in the art.

Please see below for an updated rejection to the claims.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 4-11, and 25-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arbore (US 6970631).

With respect to claims 1, 6-7 and 26, Arbore teaches an optical fiber for producing laser radiation at a characteristic wavelength, the optical fiber comprising: a first multimode core region (fig.1 #14, supporting multiple modes as shown in the fig.) having a first index of refraction ( $n_1$ ), the core region being adapted for guiding laser radiation in a longitudinal direction of the fiber and adapted for guiding pump radiation

Art Unit: 2828

(col.4 lines 38-48), and an active region (fig.1 #12, index no) embedded within the core region for producing radiation at the characteristic wavelength when pumped by pump radiation (incoming photons from the pump beam excite the laser ions, an input signal beam then triggers the emission of additional photons from the gain medium at the characteristic wavelength, fig.9), the active region having a sufficiently small transverse dimension such that radiation produced in the active region is not confined to the active region (fig.1, laser radiation clearly not confined in active region #12, as the index of region #14 and #12 are not equal, the transverse dimension must then be less than the emitted wavelength to account for the unconfined wave). Arbore additionally teaches less than about 50% of the radiation produced at the characteristic wavelength in the active region is confined to the active region (fig.1 mode #24 corresponding to the characteristic wavelength, shown to be confined slightly less than 50%). Arbore does not teach less than 10% of the radiation to be confined to the active region. It would have been obvious to one of ordinary skill in the art at the time of the invention to select a confinement in this range as it has been found to be within the skill of a general worker in the art to discover the optimum or workable range (see MPEP 2144.05 II A - In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

With respect to claims 4-5, Arbore teaches the fiber system outlined in the rejection to claim 1, but does not teach the radiation confined to the active region to be less than 5% or 2%. It would have been obvious to one of ordinary skill in the art at the time of the invention to select a confinement in this range as it has been found to be within the skill of a general worker in the art to discover the optimum or workable range

Art Unit: 2828

(see MPEP 2144.05 II A - In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

With respect to claims 8 and 27, Arbore teaches the lowest mode can be chosen to be the desired mode (fig.1 #24, col.6 lines 33-39).

With respect to claim 9 and 28, Arbore teaches the desired mode is a Gaussian mode of the optical fiber (fig.1 #24).

With respect to claims 10 and 29, Arbore teaches the optical fiber has gain along its longitudinal direction that is sufficiently small (fig.1 #12), so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold (col.10 lines 9-32, discussing how the gain is positive for the fundamental mode, and lossy for the modes above this cutoff, meaning that the fundamental mode would overcome the losses and lase prior to the other modes).

With respect to claims 11 and 25, Arbore teaches the optical fiber to comprise a mode discriminator for discriminating against undesired modes of light generated in the multimode fiber while allowing a desired mode of light to propagate in the fiber (cols.11-12 lines 30-30).

With respect to claim 30, Arbore teaches a method of providing laser energy with a characteristic wavelength in a single optical mode to a surface comprising: pumping an active region embedded in a multimode optical fiber with pump energy to produce the laser energy with the characteristic wavelength (incoming photons from the pump beam excite the laser ions, an input signal beam then triggers the emission of additional photons from the gain medium at the characteristic

Art Unit: 2828

wavelength, fig.9), wherein the active region has a transverse dimension smaller than the characteristic wavelength such that radiation produced in the active region is not confined to the active region (fig.1, laser radiation clearly not confined in active region #12, as the index of region #14 and #12 are not equal, the transverse dimension must then be less than the emitted wavelength to account for the unconfined wave), and guiding the generated light to the surface with the multimode fiber (fig.9) through a first multimode core region having a first index of refraction (fig.1). Arbore additionally teaches less than about 50% of the radiation produced at the characteristic wavelength in the active region is confined to the active region (fig.1 mode #24 corresponding to the characteristic wavelength, shown to be confined slightly less than 50%). Arbore does not teach less than 10% of the radiation to be confined to the active region. It would have been obvious to one of ordinary skill in the art at the time of the invention to select a confinement in this range as it has been found to be within the skill of a general worker in the art to discover the optimum or workable range (see MPEP 2144.05 II A - In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

Claims 12-14 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arbore in view of Fermann et al. (US 6954575).

With respect to claims 12-14, Arbore teaches the fiber system as outlined in the rejection to claim 11, but does not teach a free space propagation path defined between a mirror and the multimode fiber. Fermann teaches a fiber system which uses a mirror

Art Unit: 2828

(saturable absorbing) between a free space propagation path and a multimode fiber (fig.11, col.14 lines 51-67, being used for active mode locking, inherently filtering out and reflecting back to the fiber only the desired mode). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Arbore with the propagation/ mirror system of Fermann in order to enable active mode locking and the generation of short optical pulses (Fermann, col.14 lines 62-67).

With respect to claim 18, Arbore teaches the fiber system as outlined in the rejection to claim 11, but does not teach the use of fiber gratings. Fermann teaches a fiber system which uses a fiber grating (col.15 lines 1-13). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Arbore with the grating of Fermann in order to further restrict the modal profile of the system, as is a widely known and used function of fiber gratings.

Claims 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arbore in view of Caracci et al. (US 6445838).

With respect to claims 15-17, Arbore teaches the fiber system as outlined in the rejection to claim 11, but does not teach a second optical fiber for guiding the laser radiation, wherein the mode discriminator is a free space propagation path between the first multimode fiber and the second multimode fiber, or a lens disposed between said fibers. Caracci teaches a tunable optical component which uses a split in a fiber segment, creating a free space path, as well as a lens (col.6 lines 27-34), to tune the wavelength. It would have been obvious to one of ordinary skill in the art at the time of



Art Unit: 2828

the invention to combine the fiber system of Arbore with the splitting technique of Caracci, resulting in two multimode fiber sections, in order to have the ability to tune the confined light, eliminating unwanted modes, as well as to use a lens to insure the proper coupling of the light from segment to segment.

Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arbore in view of Wyatt et al. (US 5774484).

With respect to claims 19-20, Arbore teaches the fiber system as outlined in the rejection to claim 11, but does not teach a second multimode fiber for guiding the laser radiation, and wherein the mode discriminator is a third multimode fiber (with radially varying index) located between the first multimode fiber and the second. Wyatt teaches an optical fiber system wherein is used a second multimode fiber for guiding the laser radiation, and wherein the mode discriminator is a third multimode fiber (radially varying index, col.3 lines 30-35) located between the first multimode fiber and the second (fig.3, fibers 1a, 2a, 1b, 2b, mode discrimination occurring via gratings in fiber 2a). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Arbore with the multi-fiber system of Wyatt in order to perform mono-mode up-conversion of the pump laser beam (Wyatt, col.4 lines 30-45) to obtain frequencies not available from the pump source.

Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arbore in view of Zellmer et al. (US 2002/0018287).

With respect to claims 21-24, Arbore teaches the fiber system as outlined in the rejection to claim 11, but does not teach the use of multiple sections of fiber bent in the shape of kidneys, lying in non-parallel planes. Zellmer teaches a fiber system which uses multiple sections of fiber bent in the shape of kidneys, lying in non-parallel planes (fig.6 #27, multiple bent sections, in the shape of kidneys, lying in non-parallel planes). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Arbore with the bent fiber sections of Zellmer in order to allow for selection, or elimination, of transverse modes in the waveguide (Zellmer, [0022], [0030]).

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

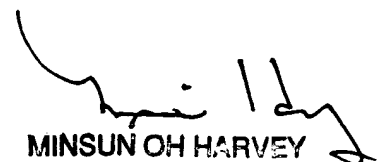
Art Unit: 2828

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR



**MINSUN OH HARVEY**  
**PRIMARY EXAMINER**